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GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS

IN WESTERN COLORADO, USING SKYLAB EREP DATA

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Monthly Progress Report

July-August 1974

EREP Investigation 380

Contract NAS-13394

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INTRODUCTION

The primary objective of the CSM Skylab Program is to analyze EREP data for geologic information. To this end, the research has been subdivided into the following tasks;

- Task I. The PI shall assist NASA/MSC in mission planning activities related to the proposed investigation.
- Task II. The investigator will screen all EREP data obtained over Colorado and will select frames for detailed study.
- Task III. The investigator will prepare photogeologic maps using selected S-190 photographs, and will analyze them to determine what geologic information may be contained in them.
- Task IV. The geological interpretations obtained in Task 3 will be compared to interpretations obtained from S-192 imagery, and to interpretations made from ERTS-I imagery.
- Task V. The geological interpretations will be verified by means of interpretation of aerial photographs, published geological reports, and field observations.
- Task VI. The investigator will prepare recommendations for the optimum type, scale, and resolution of imagery to be used for studies of regional geology and exploration for mineral deposits and water resources.

PROGRESS

Overall Status

With this report, Milestones 1 through 24 have been achieved, with the following exceptions: Milestones 14 and 16 have not been achieved because the Skylab 4 data have not yet been received; Milestone 18 has been partially completed; Milestone 20 has not been achieved due to lack of receipt of S192 processed data; Milestone 23 has been achieved in some part.

Past Month's Activities

Some time was spent in the office and laboratory in analysis of structural trends in linears features on orbital and high altitude photography. Most of the effort in July and August, however, was directed toward field investigations. These field investigations were conducted primarily in three areas: the Colorado Front Range, a central portion of the Colorado mineral belt, and in southwestern Colorado and southeastern Utah.

Field work in the Colorado Front Range investigated large linear features in the Rampart Range and southern Front Range. Structural features associated with the linears in the Rampart Range have been mapped previously in part, and time was spent in tying these segments together using orbital and aircraft photography. Ground identification of crushed zones and clastic dikes along the linears in the Pikes Peak granite was not too difficult; however, in the southern Front Range, the identification of the origin of the linears in the metamorphic terrain was more difficult. It is concluded that the linears have associated with them higher frequencies of prospect pits, mafic dikes, green mineralization and crushed zones. One linear also is associated with a major long linear valley.

An area in the central Colorado mineral belt, near Weston Pass, was selected for intensive ground study because interpretations of Skylab photos revealed complex structure and color anomalies. Within the study area there are several through-going, near-vertical faults

with displacements on the order of 1,000-2,000 feet. The Weston fault zone and other faults with less displacement may have served as channelways for mineralizing fluids moving from centers of mineralization near the Weston fault zones. These fluids often deposited their gangue and ore minerals in permeable and reactive strata, particularly the Paleozoic carbonates. Color anomalies found in this study area may be attributed to (a) abundant microcline crystals (b) limonitic alteration, in both crystalline and sedimentary rocks, (c) hydrothermal and/or deuteric bleaching (sericitization and kaolinization) or (d) syngenetic coloration of sediments, such as red and purple sandstones and shales. The color anomalies seen in and near the study area on Skylab 3 S190B photos were all caused by either (a) or (b). The differences between these color anomalies generally cannot be recognized on satellite photography.

In the San Juan economic geology project, surface and underground studies were conducted during July-August 1974 devoted to field evaluation of at least 23 lineaments, ranging 14 to 120 miles in length. Field evaluation of lineaments and their wall rocks embraced the following concepts and relations: (1) evaluation of the geologic significance of lineaments (2) laccolithic (?) domal intrusions occur along and tangent to lineaments but not at intersections, (3) calderas occur at intersections of lineaments, (4) time-space, time-span location and occurrence of metalliferous deposits in relation to calderas, and (5) time-space, time-span relations of metalliferous deposits to lineaments or lineament systems.

Interpretatively-derived questions that were treated during field studies were (in order of priority): (1) geologic nature (?) and origin of lineaments, (2) time-space, time-span relation of calderas to lineaments, (3) relation of lineament trends and systems to regional tectonics, (4) presence of any other possible calderas or domical structures seen or not seen on photography and imagery that

are not presently recognized, (5) field evidence either refuting or confirming the validity of the volcano-tectonic-metallogenetic sequence so far indicated by Skylab and ERTS-1 image analysis, (6) the possible existence of a so-called "volcano-tectonic-metallogenetic" model, and (7) evaluation of whether large-scale surface and underground mapping studies relate to small-scale studies. Field observations for each lineament or lineament system were recorded on three field observation form sheets developed for this project.

Skylab photography and ERTS imagery are being used and interpreted (supplemented by aircraft photography where appropriate) for lithologic discrimination of at least 14 individual plutons representing three distinct periods of Precambrian plutonism and attendant metamorphism that encompassed a 700-million-year time-span throughout a 10,000 square mile area in the central Colorado Rocky Mountains. The photo and imagery interpretations are correlated with existing field data, specifically with reference to intrabatholithic lithologies and granite-tectonic features of Pikes Peak batholith and its immediate wall rocks. Existing field data for Pikes Peak batholith and the area of surrounding Precambrian basement rocks has been collected already from field studies during the past 16 years.

Field work in the Uncompahgre Uplift-Paradox Basin area was directed largely at field checking photo interpretations of Skylab S190 photos. Lithologic contacts, as mapped from the satellite photos, were found to be very reliable. Linear structural information was found to be less reliable, although these types of data proved to be most contributory to new geologic information. Field checking verified the existence of a major graben structure, interpreted from the Skylab photos, that had not been previously mapped, and similar checking verified a lateral extension of another major fault system. The surface expressions of some of the photo faults were extremely subtle.

Planned Activities for Current Month

Research during September will be directed largely towards analysis of summer field work.

Travel

Travel during July-August consisted of one man-trip to the Houston data meeting and approximately 25 man-days spent in the field in the areas mentioned above.

No travel is anticipated during September.

Outlook and Recommendation

Progress continues to be satisfactory, although still behind schedule because of the late start and delays in data receipt. With the time extension through the end of June 1975, the project should be completed satisfactorily.



Keenan Lee
Principal Investigator